Introduction

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The base of the Silurian System was agreed by the I.U.G.S. Executive Committee in May 1985 (published June 1985 in Bassett 1985), and was taken at the base of the *acuminatus* Zone at Dob's Linn, Scotland (Cocks 1985).

This volume closely reflects the achievements of the Ordovician–Silurian Boundary Working Group from its formation in 1974 to its disbandment in 1985. A detailed account of the activities of the Group is given in the next chapter, including the procedures followed which led to the decision on the definition of the boundary. We have taken the opportunity to gather in this book a global review of the Ordovician–Silurian boundary. These contributions are partly based on submissions on places and fossil groups made during the lifetime of the Working Groups and circulated by the Secretary, but these, if used in this volume, have been thoroughly updated by the respective authors and their colleagues. In addition we have commissioned a number of papers to give an overview of the many places where the boundary is exposed, as well as others on the global analysis of sedimentary events, and the evolutionary progress of the most important biological groups across the boundary.

It has always been clear from discussions that unanimous agreement would never be possible. Different countries have different traditions and philosophies, for example with respect to stratigraphical principles. This is especially true of the concepts of zones, and of the utility of zones for correlative purposes. For example, Mu (this volume) attempts a very detailed correlation of what are regarded elsewhere as potential subdivisions of the *acuminatus* Zone, claiming that an *ascensus* fauna underlies the *acuminatus* Zone (as it is, indeed, seen in China). But in some of the most precisely and exhaustively collected sections, such as at Dob's Linn, Scotland, it seems clear that the two species appear more or less simultaneously, albeit with *ascensus* more abundant low in the zone, and *acuminatus* more common in the upper part of the zone and outlasting *ascensus*. Thus, whilst there is a case for locally subdividing an *acuminatus* Zone, as Teller (1969) and others have sensibly done, it should be made clear that on current information these subdivisions correlate in total with the *acuminatus* Zone at Dob's Linn. In sections where the record is perhaps not very complete, or the fauna not abundant, it may appear that *acuminatus* follows *ascensus*.

Barnes (this volume) considers that, although the systemic boundary has now been fixed, its 'reconsideration may be necessary' (Lespérance *et al.* 1987). The main grounds for this opinion are that the Anticosti sequence has a future potential for further studies; has all the attributes for a boundary stratotype; and that 'important stratigraphic principles have been disregarded or overruled in making the final stratotype decision'. It cannot be overemphasized that the procedures adopted by the Working Party Group throughout its life were correct, proper, democratic, and always in accord with I.U.G.S. guidelines and with specific guidance from I.U.G.S.

If some stratigraphical ideas have been disregarded or overruled, then a substantial majority of the Working Group took the decisions to do so: the voting which took place is recorded in the next section. 'Potential' is always a difficult commodity to evaluate: and the judged potential of a section cannot delay for ever what will always be arbitrary decisions in the end. By the time a reconsideration was worked through (? ten years) another section would no doubt be vying with Anticosti in terms of its potential. Where then?

That Anticosti has most of the attributes necessary for a boundary stratotype is beyond question. That is why it was on a short list of two, voted upon by the Working Group. Other sections were of an almost equally high standard, for example, in China and the Lake District of England. But Anticosti does have one very serious drawback in any current discussions on

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correlations about the boundary, and that is its seemingly poor record of graptolites. It may be that at some future time graptolites may be relatively demoted in value for correlative purposes, but that time is still far away on present information. Dob's Linn *also* has most of the attributes of a boundary stratotype, and the Working Group, after eleven years of study, considered it better than Anticosti. In fact, the boundary has now been certainly put at the correct level, using the best group for correlation, the graptolites. Despite the fact that the *Hirnantia* brachiopod fauna is very often overlain by *persculptus* Zone graptolites, unequivocal evidence from both Kazakhstan (Koren *et al.* this volume) and the Lake District of England (Cocks this volume) shows that it also occurs rarely within the *persculptus* Zone. There is a strong feeling amongst most biostratigraphers that they prefer to regard the *Hirnantia* fauna as Ordovician rather than Silurian in age and not straddling the systematic boundary, and this assignment to the Ordovician can be achieved only by a sub-*acuminatus* Zone boundary, as was eventually decided.

A more interesting question is the precise age, in terms of graptolite zones, of the maximum glacio-eustatic drop in sea level, and this is still not yet definitively answered although it was probably about half way through the *persculptus* Zone—there are some well-dated *persculptus* bearing post-glacial transgressive beds in parts of North Africa. On the other hand, the precise duration and extent of the glacial episode (Fig. 1) certainly varied from place to place—commencing even in late Caradoc and early Ashgill times in some parts of Gondwana, and certainly continuing into post-*Hirnantia* fauna times, perhaps into the Rhuddanian, in others, e.g. South Africa. It is also important to note that detailed investigation indicates that the 'end

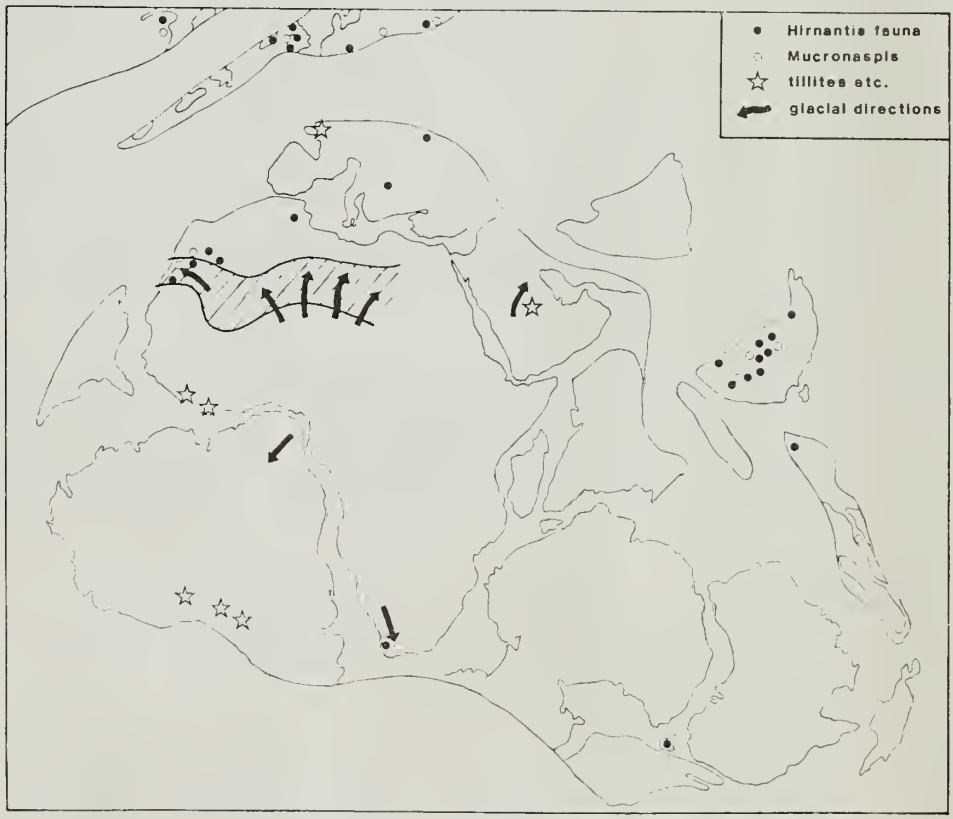

Fig. 1 Distribution of the latest Ordovician glacial deposits in Gondwana and adjacent areas (after Cocks & Fortey 1988).

Ordovician' faunal extinctions were by no means synchronous. No other faunal or floral group than graptolites yet approaches the sensitivity and exactness of the graptolites during the period in question—for example from the mid-Ashgill (base of the Rawtheyan) to the end of the early Llandovery (Rhuddanian) there are no fewer than eight graptolite zones, as compared with three or four conodont zones, and four successive brachiopod faunas, three or four ostacod faunas, three or four trilobite faunas etc. This, from a period of only perhaps 7 or 8 million years (McKerrow *et al.* 1985), makes the graptolites compare well with Mesozoic ammonites or Tertiary foraminifera as a precise dating tool.

The coverage in this volume of the Ordovician–Silurian sections themselves cannot be total partly because several regions are little known. However, it is worth drawing attention here to probable additional Ordovician–Silurian boundary sections in Libya (Klitzsch 1981), Burma (Mitchell *et al.* 1977; Wolfart *et al.* 1984) and Greenland (e.g. Hurst & Kerr 1982; Surlyk & Hurst 1984). In addition we are aware of preliminary work on strata about the boundary in Vietnam, Thailand, Malaysia and other parts of SE Asia. In the instance of central Nevada, U.S.A., we have not republished a revised preliminary submission because there is nothing yet new to add to the work by Berry (1986). There is also further work in preparation on Scandinavia.

We would like to end this introduction with a tribute to the many people involved, both as members of the Working Group and as contributors to the present volume, who patiently took part in the meetings, newsletter, activities and final decision-making, and thank them all for their patience, support, good humour and international friendship; despite the controversy of the eventual scientific conclusion.

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